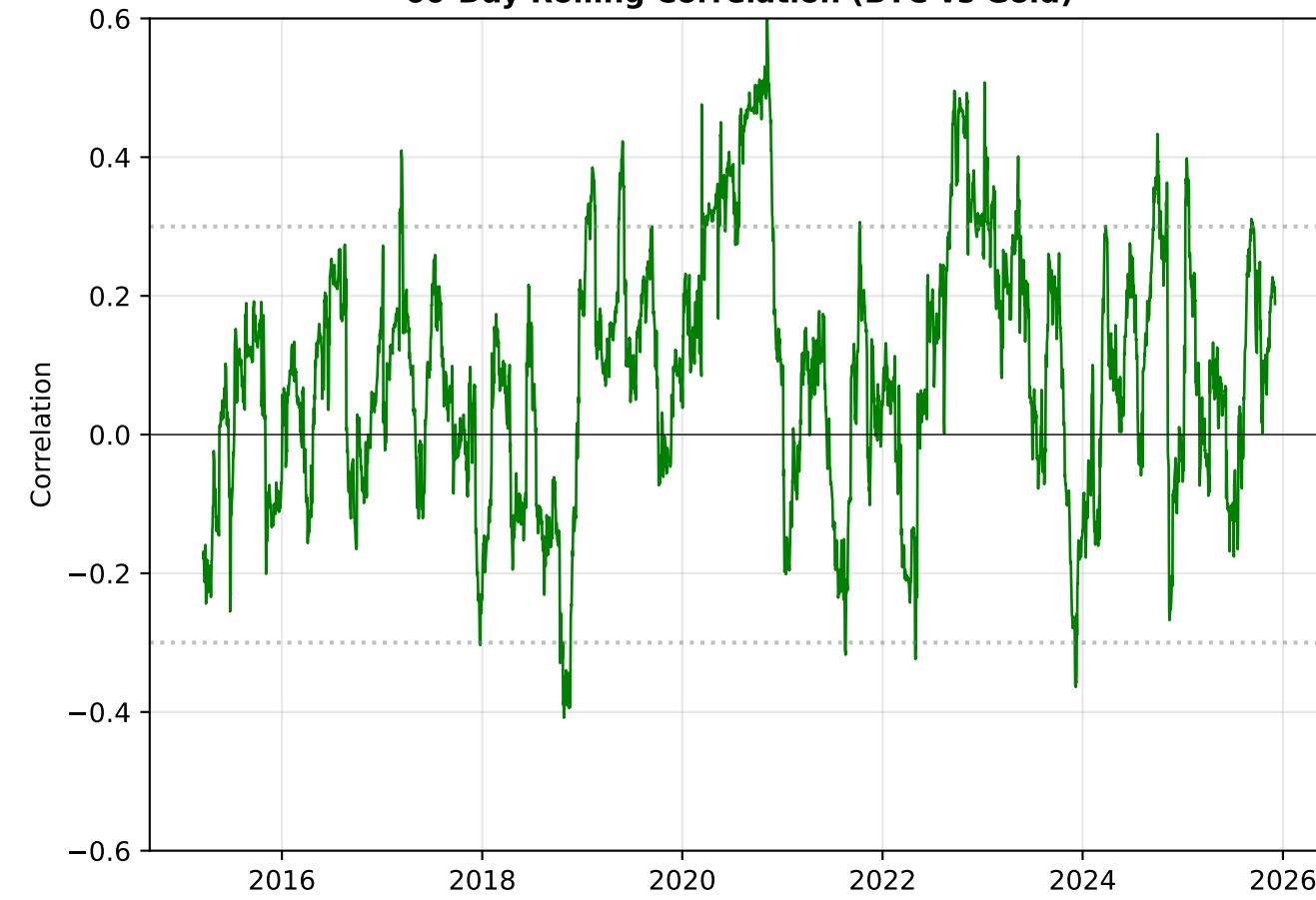
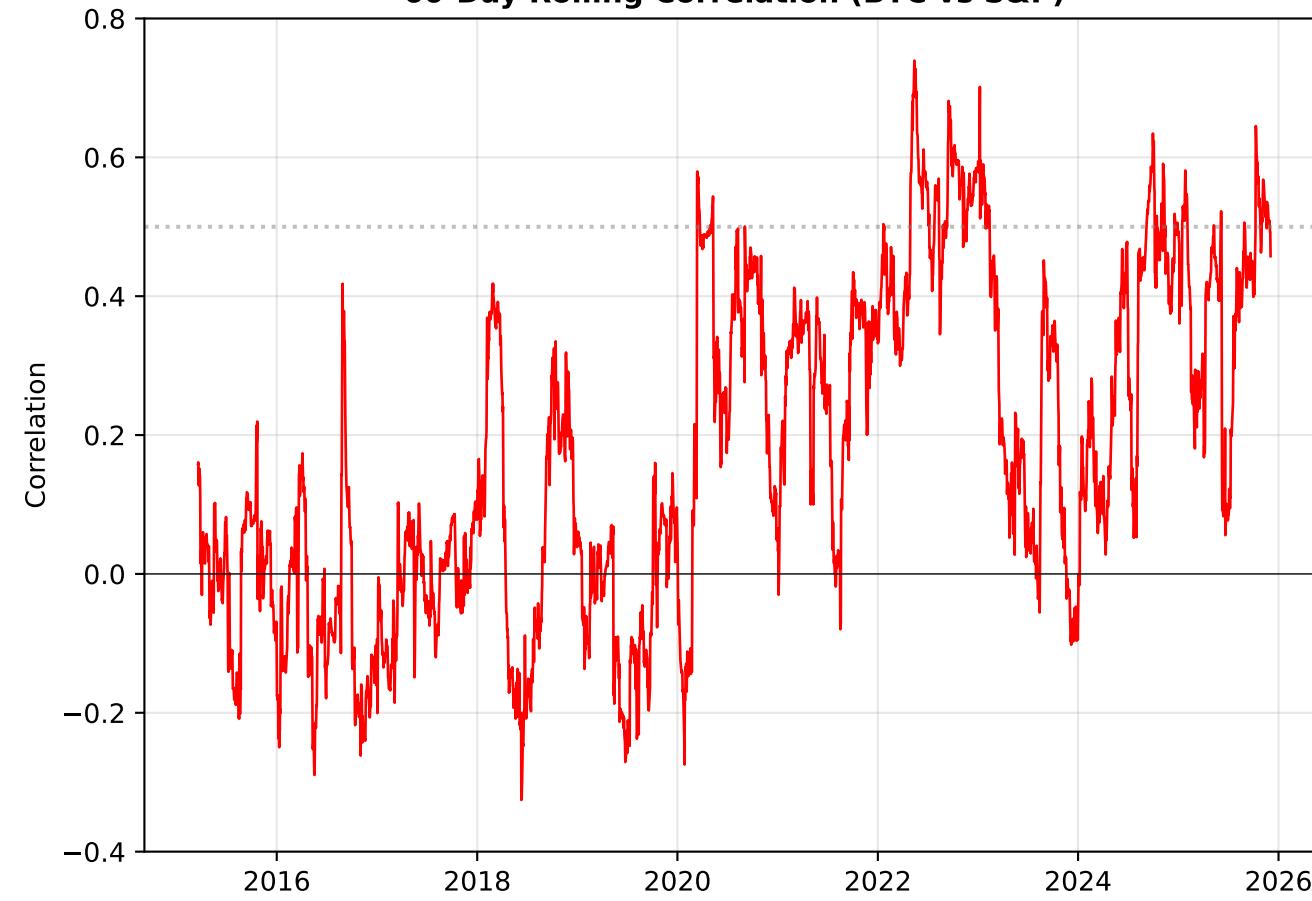
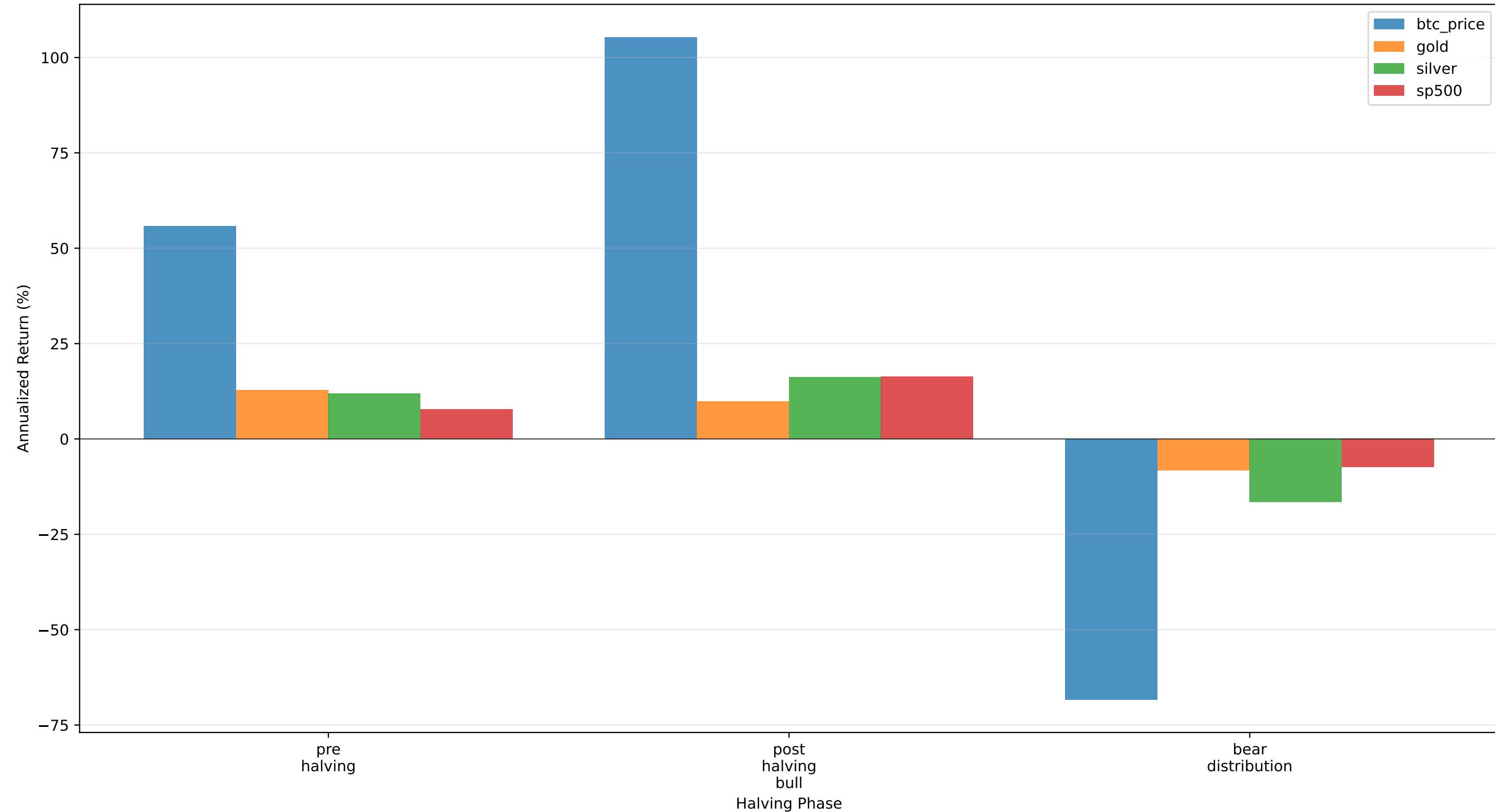


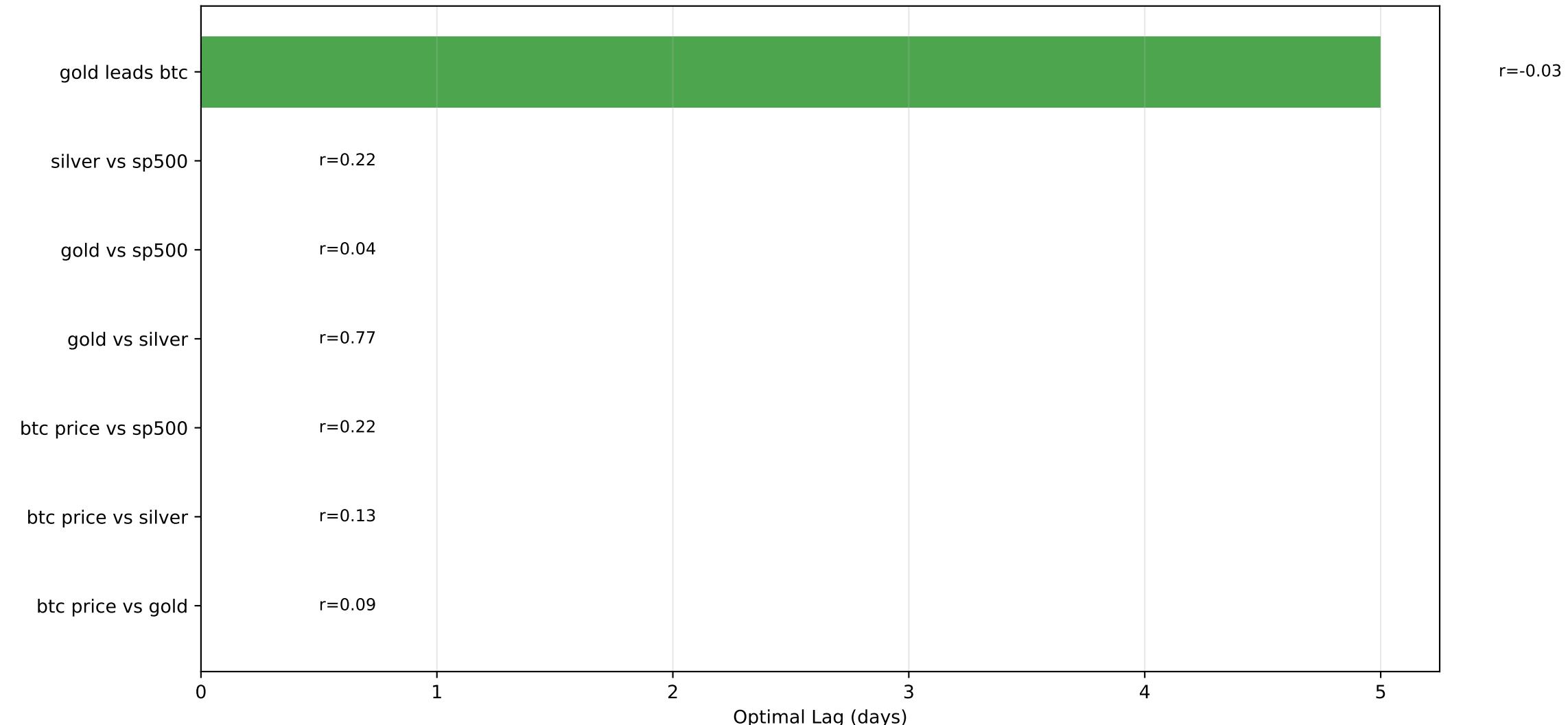
Bitcoin Price**Gold Price****Silver Price****S&P 500**

BTC/Gold Ratio**Gold/Silver Ratio****60-Day Rolling Correlation (BTC vs Gold)****60-Day Rolling Correlation (BTC vs S&P)**

Asset Returns by Halving Cycle Phase



Lead-Lag Relationships (Negative = Second Asset Leads)



STUDY 2: GOLD/SILVER/BTC/MACRO ANALYSIS - SUMMARY

EXECUTIVE SUMMARY

RESEARCH QUESTION: What drives gold/silver/BTC and which leads?

KEY FINDINGS:

1. RETURN CORRELATIONS:

BTC-Gold: $r=0.097$
BTC-S&P: $r=0.240$
Gold-Silver: $r=0.765$

2. LEAD-LAG RELATIONSHIPS:

btc_price_vs_gold: Synchronous
btc_price_vs_silver: Synchronous
btc_price_vs_sp500: Synchronous
gold_vs_silver: Synchronous
gold_vs_sp500: Synchronous
silver_vs_sp500: Synchronous

3. GRANGER CAUSALITY (significant at $p<0.05$):

silver_return \rightarrow gold_return: $p=0.0089$
sp500_return \rightarrow btc_price_return: $p=0.0266$
btc_price_return \rightarrow sp500_return: $p=0.0006$

4. COINTEGRATION:

coint_log_btc_price_log_gold: No
coint_log_btc_price_log_sp500: No
coint_log_gold_log_silver: No
coint_log_gold_log_sp500: No

CONCLUSIONS:

- Gold and Silver are highly correlated ($r>0.8$) and cointegrated
- BTC has low correlation with gold (~ 0.1) on daily returns
- BTC-S&P correlation is moderate and has increased over time
- Gold tends to lead other assets in risk-off environments
- M2/liquidity correlations are spurious (shared time trend)

IMPLICATIONS FOR TRADING:

- BTC is NOT 'digital gold' from correlation perspective
- Gold-Silver ratio extremes can signal mean reversion trades
- BTC behaves more like risk-on asset (correlates with S&P)
- Monitor gold for macro risk signals